

WHAT IS CLAIMED IS:

1. A control apparatus for taking failure
countermeasure for a hybrid vehicular drive system,
5 comprising:

a planetary gear mechanism to which four elements
of an engine, a first motor/generator, a second
motor/generator, and an output member are linked in
such a manner that, on a lever diagram of the
10 planetary gear mechanism, a revolution speed order is
the first motor/generator, the engine, the output
member, and the second motor/generator;

first and second clutching sections that are
arranged at one and the other ends of the lever
15 diagram with the output member as an intermediate
position on the lever diagram, each of the first and
second clutching section prescribing a speed line
according to a clutching thereof;

a drive source output abnormality detecting
20 section that detects an output abnormality of each of
the engine, the first motor/generator, and the second
motor/generator which are drive sources; and

a drive source failure countermeasure control
section that, with one of the first and second
25 clutching sections clutched, enables a vehicular run
using at least one of the drive sources whose output
is detected to be normal when the drive source output
abnormality detecting section detects that the output
abnormalities in any one or two of the drive sources
30 occur.

2. A control apparatus for taking failure

countermeasure for a hybrid vehicular drive system as claimed in claim 1, wherein the first clutching section is a high-brake arranged at a position on the lever diagram coincident with a revolution speed axle of first motor/generator to fix a gear ratio when
5 clutched and the second clutching section is a low-brake arranged at a position on the lever diagram between the revolution speed axle of the output member and the revolution speed axle of the second
10 motor/generator to fix the gear ratio when clutched.

3. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure
15 countermeasure control section fixes a run mode of the vehicle to a high-brake clutching run mode with the engine as the drive source when the output abnormality in at least one of the outputs of the first motor/generator and the second motor/generator
20 is detected to occur during a brake release run mode with the engine, the first motor/generator, and the second motor/generator as the drive sources.

4. A control apparatus for taking failure
25 countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section fixes the run mode of the vehicle to a low-brake clutching run mode with at least engine as the drive source when the abnormality
30 in at least one of the outputs of the first motor/generator and the second motor/generator is detected to occur during the low-brake clutching run mode with the engine as the drive source.

5. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section fixes the run mode of the vehicle to the high-brake clutching run mode with the second motor/generator as the drive source when the abnormality in the output of the engine is detected to occur during the brake release run mode with the engine, the first motor/generator, and the second motor/generator as the drive sources.

6. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section fixes the run mode to the low-brake clutching run mode with both of the first motor/generator and the second motor/generator as the drive sources when the abnormality of the output of the engine is detected to occur during the low-brake clutching run mode with the engine as the drive source.

7. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section starts the engine with at least one of the high-brake and the low-brake clutched and with one of the first and second motors/generators which is detected to be normal as the drive source when the abnormality in at least one of the outputs of the first and second motors/generators is detected to occur during the run

mode with at least one of the first and second motor/generator as the drive source and with a stop of the engine.

5 8. A control apparatus for taking failure
countermeasure for a hybrid vehicular drive system as
claimed in claim 2, wherein the drive source failure
countermeasure control section starts the engine
utilizing a vehicular inertia with at least one of
10 the high-brake and the low-brake clutched when the
abnormality in the outputs of both of the first and
second motors/generators is detected to occur during
the run mode with at least one of the first and
second motors/generators as the drive source and with
15 a stop of the engine.

9. A control apparatus for taking failure
countermeasure for a hybrid vehicular drive system as
claimed in claim 2, wherein the drive source failure
20 countermeasure control section achieves a two-stage
gear ratio run mode between a low gear ratio by means
of the clutching of the low-brake with the engine as
the drive source and a high gear ratio by means of
the clutching of the high-brake with the engine as
25 the drive source when the engine is detected to be
normal but the abnormality in at least one output of
the first motor/generator and the second
motor/generator is detected to occur.

30 10. A control apparatus for taking failure
countermeasure for a hybrid vehicular drive system as
claimed in claim 1, wherein the first and second
motors/generators comprises a coaxial multiple layer

motor including a stator as a stationary armature in which at least one coil is wound; an outer rotor arranged at an outside of the stator and in which a permanent magnet is buried; an inner rotor arranged
5 at an inside of the stator and in which another permanent magnet is buried; an inverter connected to the coil of the stator that produces a compound current which is a composite of a drive current for the inner rotor and another drive current for the
10 outer rotor; and a battery connected to the inverter.

11. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the planetary gear
15 mechanism comprises a Ravigneaux compound planetary gear set including five revolvable elements of: a common carrier that supports mutually meshed first pinion and second pinion; a first sun gear meshed with a first pinion; a second sun gear meshed with a
20 second pinion; a first ring gear meshed with the first pinion; and a second ring gear meshed with the second pinion and wherein the second ring gear is linked with an output axle of the engine via a clutch, the first sun gear is linked to an output axle of the
25 first motor/generator, the second sun gear is linked to an output axle of the second motor/generator, and the common carrier is linked with the output member, the revolvable elements of the Ravigneaux compound planetary gear set are linked in such the manner that
30 the revolution speed order on the lever diagram is the first motor/generator, the engine, the output member, and the second motor/generator, the high-brake is arranged at a position at which the first

sun gear is enabled to be fixed to a casing, and the low-brake is arranged at a position at which the first ring gear is enabled to be fixed to the casing.

5 12. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section fixes a run mode of the vehicle to a high-brake clutching run mode with
10 the engine as the drive source when the output abnormality in at least one of the outputs of the first motor/generator and the second motor/generator is detected to occur during the high-brake clutching run mode with the engine as the drive source.

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13. A control apparatus for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 2, wherein the drive source failure countermeasure control section fixes the run mode of
20 the vehicle to the high-brake clutching run mode with the second motor/generator as the drive source when the abnormality in the output of the engine is detected to occur during the high-brake clutching run mode with the engine as the drive source.

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14. A control method for taking failure countermeasure for a hybrid vehicular drive system, the hybrid vehicular drive system comprising: a planetary gear mechanism to which four elements of an
30 engine, a first motor/generator, a second motor/generator, and an output member are linked in such a manner that, on a lever diagram of the planetary gear mechanism, a revolution speed order is

the first motor/generator, the engine, the output member, and the second motor/generator; and first and second clutching sections that are arranged at one and the other ends of the lever diagram with the output member as an intermediate position on the lever diagram, each of the first and second clutching section prescribing a speed line according to a clutching thereof and the control method comprising:

10 detecting an output abnormality of each of the engine, the first motor/generator, and the second motor/generator which are drive sources; and
 ,with one of the first and second clutching sections clutched, enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting that the output abnormalities in any one or two of the drive sources occur.

20 15. A control method for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 14, wherein the first clutching section is a high-brake arranged at a position on the lever diagram coincident with a revolution speed axle of first motor/generator to fix a gear ratio when
25 clutched and the second clutching section is a low-brake arranged at a position on the lever diagram between the revolution speed axle of the output member and the revolution speed axle of the second
30 motor/generator to fix the gear ratio when clutched.

16. A control method for taking failure

countermeasure for a hybrid vehicular drive system as claimed in claim 15, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting
5 that the output abnormalities in any one or two of the drive sources occur, fixing a run mode of the vehicle to a high-brake clutching run mode with the engine as the drive source when the output abnormality in at least one of the outputs of the
10 first motor/generator and the second motor/generator is detected to occur during a brake release run mode with the engine, the first motor/generator, and the second motor/generator as the drive sources.

15 17. A control method for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein , at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when
20 detecting that the output abnormalities in any one or two of the drive sources occur, fixing the run mode of the vehicle to a low-brake clutching run mode with at least engine as the drive source when the abnormality in at least one of the outputs of the
25 first motor/generator and the second motor/generator is detected to occur during the low-brake clutching run mode with the engine as the drive source.

18. A control method for taking failure
30 countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting

that the output abnormalities in any one or two of the drive sources occur, fixing the run mode of the vehicle to the high-brake clutching run mode with the second motor/generator as the drive source when the
5 abnormality in the output of the engine is detected to occur during the brake release run mode with the engine, the first motor/generator, and the second motor/generator as the drive sources.

10 19. A control method for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting
15 that the output abnormalities in any one or two of the drive sources occur, fixing the run mode to the low-brake clutching run mode with both of the first motor/generator and the second motor/generator as the drive sources when the abnormality of the output of
20 the engine is detected to occur during the low-brake clutching run mode with the engine as the drive source.

20. A control method for taking failure
25 countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting that the output abnormalities in any one or
30 two of the drive sources occur, starting the engine with at least one of the high-brake and the low-brake clutched and with one of the first and second motors/generators which is detected to be normal as

the drive source when the abnormality in at least one of the outputs of the first and second motors/generators is detected to occur during the run mode with at least one of the first and second motor/generator as the drive source and with a stop of the engine.

21. A control method for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting that the output abnormalities in any one or two of the drive sources occur, achieving a two-stage gear ratio run mode between a low gear ratio by means of the clutching of the low-brake with the engine as the drive source and a high gear ratio by means of the clutching of the high-brake with the engine as the drive source when the engine is detected to be normal but the abnormality in at least one output of the first motor/generator and the second motor/generator is detected to occur.

22. A control method for taking failure countermeasure for a hybrid vehicular drive system as claimed in claim 16, wherein, at a time of enabling a vehicular run using at least one of the drive sources whose output is detected to be normal when detecting that the output abnormalities in any one or two of the drive sources occur, fixing a run mode of the vehicle to a high-brake clutching run mode with the engine as the drive source when the output abnormality in at least one of the outputs of the

first motor/generator and the second motor/generator is detected to occur during the high-brake clutching run mode with the engine as the drive source.

5 23. A control method for taking failure
countermeasure for a hybrid vehicular drive system as
claimed in claim 16, wherein, at a time of enabling
a vehicular run using at least one of the drive
sources whose output is detected to be normal when
10 detecting that the output abnormalities in any one or
two of the drive sources occur, fixing the run mode
of the vehicle to the high-brake clutching run mode
with the second motor/generator as the drive source
when the abnormality in the output of the engine is
15 detected to occur during the high-brake clutching run
mode with the engine as the drive source.

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